

## European Technical Approval ETA-13/0534

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung  
*Trade name*

Naturdach

Zulassungsinhaber  
*Holder of approval*

Optigrün international AG  
Am Birkenstock 19  
72505 Krauchenwies  
DEUTSCHLAND

Zulassungsgegenstand  
und Verwendungszweck  
*Generic type and use  
of construction product*

Bausätze für Dachbegrünungen  
*Kit for Green Roofs*

Geltungsdauer:  
*Validity:* vom  
from  
bis  
to

22 June 2013  
22 June 2018

Herstellwerk  
*Manufacturing plant*

Optigrün international AG  
Am Birkenstock 19  
72505 Krauchenwies  
DEUTSCHLAND

Diese Zulassung umfasst  
*This Approval contains*

14 Seiten einschließlich 2 Anhänge  
*14 pages including 2 annexes*

## I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
  - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998<sup>4</sup>, as amended by Article 2 of the law of 8 November 2011<sup>5</sup>;
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
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- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

<sup>1</sup> Official Journal of the European Communities L 40, 11 February 1989, p. 12

<sup>2</sup> Official Journal of the European Communities L 220, 30 August 1993, p. 1

<sup>3</sup> Official Journal of the European Union L 284, 31 October 2003, p. 25

<sup>4</sup> *Bundesgesetzblatt Teil I* 1998, p. 812

<sup>5</sup> *Bundesgesetzblatt Teil I* 2011, p. 2178

<sup>6</sup> Official Journal of the European Communities L 17, 20 January 1994, p. 34

## II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

### 1 Definition of products and intended use

The kit for green roofs "Naturdach", hereinafter referred to as GRK (Green Roof Kit), is planned and executed according to the installation instructions of the approval holder deposited with Deutsches Institut für Bautechnik (DIBt).

The GRK consist of the components specified in section 1.1, which are factory-made by the approval holder or a supplier. The GRK is manufactured on site from these components. In the end, it is the approval holder who is responsible for the GRK.

#### 1.1 Definition of the construction product

The GRK is placed above the roof covering on flat roofs and sloped roofs, respectively with a roof pitch of a maximum of 15° and consist of the components stated in Table 1 (bottom-up).

The roof covering and the greening (plants) are not included in the kit.

Table 1: Components of the kit for green roofs

	Components (see section 2.3 for more details, properties and performances)	Type of material	thickness, mass surface density
<b>Protection mat</b>	Separation, protection and storage fleece RMS 350	PP/PET	3.35 mm 350 g/m <sup>2</sup>
<b>Drainage element</b>	Drainage and storage element FKD 40	Recycling HDPE (pre-consumer-material)	40 mm 2.3 kg/m <sup>2</sup>
<b>Filter fleece</b>	Filter mat type 105	PP	1.1 mm 0.15 kg/m <sup>2</sup>
<b>Vegetation support layer</b>	Vegetation substrate type E light	mineral multilayer substrate	approx. 96 kg/m <sup>2</sup>
	Vegetation substrate type E heavy	mineral multilayer substrate	approx. 115 kg/m <sup>2</sup>

#### 1.2 Intended use

The GRK is used for the production of green roofs. It protects the roof covering from UV radiation, temperature differences, and mechanical damage.

By the use of the GRK, a part of the incoming precipitable water can be held back and thus costs for the drainage systems will be reduced.

The selection of the GRK in conjunction with an appropriate planting depends on the concrete conditions at the place of installation and is not the subject of this European technical approval.

The provisions made in this European technical approval (ETA) are based on an assumed working life of the GRK of 25 years; provided that the conditions laid down in section(s) 4.2/5.1/5.2 for the packaging, transport, storage, installation, use, maintenance and repair are met. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

## 2 Characteristics of the products and methods of verification

### 2.1 General

The assessment of the fitness of the GRK for the intended use was carried in accordance with the EOTA<sup>7</sup> assessment criteria No. 04.01/11 "Kits for Green Roofs" (Version May 2011).

### 2.2 Characteristics of the assembled system / kit for green roofs

#### 2.2.1 External fire performance

When observing the requirements given in Annex 1.1 and Annex 1.2 roof structures including the GRK satisfy the requirements of class B<sub>ROOF</sub> (t1) according to EN 13501-5:2005+A1:2009 without further testing.

#### 2.2.2 Discharge coefficient C / runoff reference value C

The discharge coefficient C / the runoff reference value C for different rainfalls r is determined according to clause 5 of attachment 2 of the "Green Roofing Guideline" - Guideline for the Planning, Construction and Maintenance of Green Roofing (2008 edition).

Table 2 lists the discharge coefficients as a function of the roof structure, applicable to roof slopes  $\leq 5^\circ$ .

Table 2: Discharge coefficients C / runoff reference values C

Roof build-up	Rainfall	Discharge coefficient / runoff reference value C
2 % slope Separation, protection and storage fleece RMS 350 Drainage and storage element FKD 40 Filter mat type 105 Vegetation substrate type E light, 60 mm thick	300 l/(s x ha) / Duration: 15 Min	C = 0.56

Roof build-up	Rainfall	Discharge coefficient / runoff reference value C
<p>2 % slope</p> <p>Separation, protection and storage fleece RMS 350</p> <p>Drainage and storage element FKD 40</p> <p>Filter mat type 105</p> <p>Vegetation substrate type E light, 80 mm thick</p>	300 l/(s x ha) / Duration: 15 Min	C = 0.50
<p>2 % slope</p> <p>Separation, protection and storage fleece RMS 350</p> <p>Drainage and storage element FKD 40</p> <p>filter mat type 105</p> <p>Vegetation substrate type E light, 100 mm thick</p>	300 l/(s x ha) / Duration: 15 Min	C = 0.45
<p>0 % slope</p> <p>Separation, protection and storage fleece RMS 350</p> <p>Drainage and storage element FKD 40</p> <p>Filter mat type 105</p> <p>Vegetation substrate type E light, 60 mm thick</p>	300 l/(s x ha) / Duration: 15 Min	C = 0.41
<p>0 % slope</p> <p>Separation, protection and storage fleece RMS 350</p> <p>Drainage and storage element FKD 40</p> <p>Filter mat type 105</p> <p>Vegetation substrate type E light, 80 mm thick</p>	300 l/(s x ha) / Duration: 15 Min	C = 0.37
<p>0 % slope</p> <p>Separation, protection and storage fleece RMS 350</p> <p>Drainage and storage element FKD 40</p>	300 l/(s x ha) / Duration: 15 Min	C = 0.27

Roof build-up	Rainfall	Discharge coefficient / runoff reference value C
Filter mat type 105 Vegetation substrate type E light, 100 mm thick		

### 2.2.3 Resistance to wind loads

The assessment of the resistance to wind loads is not subject of the European technical approval. The verification shall be provided by the planner for the respective construction works taking account of EN 1991-1-4 as well as the relevant applicable national provisions.

### 2.2.4 Release of dangerous substances or radiation

Note: In addition to the specific clauses relating to dangerous substances contained in this European technical approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

The drainage element FKD 40 is made of recycled material (see Table 1). Moreover, it contains a coloring additive which has also an UV-stabilizing effect.

## 2.3 Characteristics of the individual components

### 2.3.1 Protection mat

#### 2.3.1.1 Protection efficiency

The protection efficiency of the protection mat is determined according to EN ISO 13428:2005.

The percentage of the residual thickness  $s_r$  of the initial thickness of the lead plates is at least 20% when using the "Separation, protection and storage fleece RMS 350".

#### 2.3.1.2 Behaviour under point loads

The behaviour of the protection mat under point loads is tested according to EN ISO 12236:2006.

The maximum puncture force  $F_p$  is 3.9 kN.

#### 2.3.1.3 Tensile strength of the protection mat

The tensile strength of the protection mat is tested according to EN ISO 10319:2008. The tensile strength is at least 10 kN/m.

#### 2.3.1.4 Durability of the protection mat

The durability of the protection mat is determined for a working life of 25 years in accordance with Annex B of EN 13252 in conjunction with the EOTA assessment criteria No. 04.01/11 "Kits for Green Roofs".

The tensile strength of the protection mat is tested according to EN 29073-3:1992 before and after each aging conditioning. The tensile strength after aging amounts to at least 50 % of the initial value.

The protection mat "Separation, protection and storage fleece RMS 350" fulfils the requirements concerning resistance to hydrolysis according to EN 12447:2001 and resistance to oxidation according to EN ISO 13438:2004.

#### 2.3.1.5 Reaction to fire of the protection mat

No performance determined.

## 2.3.2 Drainage element

### 2.3.2.1 Water flow capacity of the drainage element in the plane

The water flow capacity of the drainage element in the plane is tested according to EN ISO 12958:2010.

The water flow capacity determined of the drainage element in the plane, as well as the existing boundary conditions while testing are given in Table 3 of the ETA.

Table 3: Water flow capacity [in l/(m s)]

	i = 0.01	i = 0.02	i = 0.05	i = 1.00	boundary conditions
Drainage and storage element FKD 40	1.60	2.31	3.76	16.64	Soft / rigid, 20 kPa

### 2.3.2.2 Reaction to fire of the drainage element

The fire behavior of the drainage element is tested according to EN ISO 11925-2:2010 and classified according to EN 13501-1:2007+A1:2009.

The drainage element "Drainage and storage element FKD 40" fulfils the requirements of class E according to EN 13501-1.

### 2.3.2.3 Compression behaviour of the drainage element

The compressive strength is tested according to EN ISO 25619-2:2008.

The determined compressive strength of the drainage element "Drainage and storage element FKD 40" is at least 140 kPa.

### 2.3.2.4 Compressive creep of the drainage element

No performance determined.

### 2.3.2.5 Durability of the drainage element

The durability of the drainage element shall be tested for a working life of 25 years according to Annex B of EN 13252:2000+A1:2005.

Before and after aging conditioning the compressive strength of the drainage element shall be determined according to EN ISO 25619-2:2008.

The drainage element "Drainage and storage element FKD 40" fulfils the requirements concerning microbiological resistance according to EN 12225:2004 and oxidation resistance according to EN ISO 13438:2005.

### 2.3.2.6 Tensile strength of the drainage element

No performance determined.

## 2.3.3 Filter fleece

### 2.3.3.1 Characteristic properties according to EN 13252

The filter fleece "Filter mat type 105" is a geotextile according to EN 13252:2000+A1:2005 with the characteristic properties for the functions "filtration" and "separation". The respective relevant properties are listed below.

- Tensile strength (according to EN ISO 10319) : 7.5 kN/m
- Static puncture test (CBR test) (according to EN ISO 12236) : 1200 N
- Dynamic perforation test (according to EN ISO 13433) : 28 mm
- Characteristic opening size (according to EN ISO 12956) : 105 µm
- Water permeability characteristics normal to the plane (according to EN ISO 11058) : 0.130 m/s
- Durability according to EN 13252, Annex B.



2.3.3.2 Reaction to fire of the filter fleece

No performance determined.

2.3.4 Vegetation support layer

2.3.4.1 Reaction to fire of the substrate

No performance determined.

2.3.4.2 Particle size distribution of the substrate

The particle size distribution of the substrate is determined according to EN 933-1:2012.

The maximum particle size as well as the fraction of particles < 0.063 mm and > 4 mm of the substrate are given in Table 4.

Table 4: Particle sizes

Substrate	Fraction of particles* ≤ 0.063 mm	Fraction of particles* > 4 mm	maximum particle size
Vegetation substrate type E light	8.8 % by mass	40 % by mass	22 mm
Vegetation substrate type E heavy	9.0 % by mass	31 % by mass	18 mm

\* ± 10 % tolerances

2.3.4.3 Bulk density of the substrate

The bulk density of the substrate is determined in accordance with EN 1097-3:1998.

The bulk density determined (tolerances included) is given in Table 5.

Table 5: Bulk density

Substrate	g/cm <sup>3</sup>
Vegetation substrate type E light	0.90 – 1.0
Vegetation substrate type E heavy	0.95 – 1.3

2.3.4.4 Determination of the pH-value of the substrate

The pH-value of the substrate is determined according to EN 13037:2011.

The determined pH-value of the substrate is given in Table 6.

Table 6: pH-values (tolerances included)

Substrate	pH-value
Vegetation substrate type E light	7.0 – 9.0
Vegetation substrate type E heavy	6.5 – 8.5

2.3.4.5 Determination of organic matter content

The organic matter content is determined according to EN 13039:2011.

The organic matter content determined is given in Table 7.

Table 7: Organic matter content

Substrate	Mass-%
Vegetation substrate type E light	≤ 6
Vegetation substrate type E heavy	≤ 5

2.3.4.6 Determination of soluble nutrients content

The soluble nutrients content is determined according to EN 13651:2011.

The soluble nutrients content (N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, Mg) determined is given in Table 8.



Table 8: Soluble nutrients content (in [mg/l], plus  $\pm$  10 % tolerances)

Substrate	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	MgO
Vegetation substrate type E light	26	61	96	113
Vegetation substrate type E heavy	19	184	334	115

#### 2.3.4.7 Salt content and electrical conductivity

The salt content is determined according to EN 13038:2011.

The salt content determined is given in Table 9.

Table 9: Salt content

Substrate	g/l
Vegetation substrate type E light	$\leq 2.0$
Vegetation substrate type E heavy	$\leq 2.5$

#### 2.3.4.8 Water permeability of the substrate

The water permeability of the substrate is determined according to Appendix 2 of the "Green Roofing Guideline" (2008 edition).

The determined water permeability of the substrate is given in Table 10.

Table 10: Water permeability

Substrate	cm/s
Vegetation substrate type E light	$\leq 0.04$
Vegetation substrate type E heavy	$\leq 0.007$

#### 2.3.4.9 Maximum water capacity of the substrate

The maximum water capacity of the substrate is determined according to Appendix 2 of the "Green Roofing Guideline" (2008 edition).

The determined maximum water capacity of the substrate is given in Table 11.

Table 11: Maximum water capacity

Substrate	Vol.-%
Vegetation substrate type E light	$\leq 45$
Vegetation substrate type E heavy	$\leq 60$

### 3 Evaluation and attestation of conformity and CE marking

#### 3.1 System of attestation of conformity

According to Decision 98/436/EC<sup>8</sup> of the European Commission amended by Decision 2001/596/EC<sup>9</sup>, system 4 of the attestation of conformity shall apply.

<sup>8</sup> Official Journal of the European Communities L 29/44, 03.02.1999

<sup>9</sup> Official Journal of the European Communities L 209/33, 02.08.2001

This system of attestation of conformity is defined in the following:

System 4: Declaration of conformity of the product by the manufacturer on the basis of:

Tasks for the manufacturer:

- (1) initial type-testing of the product;
- (2) factory production control.

Note: Approved bodies are also referred to as "notified bodies".

## 3.2 Responsibilities

### 3.2.1 Tasks for the manufacturer

#### 3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall ensure that the product is in conformity with this European Technical Approval.

The manufacturer may only use raw materials listed in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the test and control plan which is part of the technical documentation of this European technical approval. The test and control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.<sup>10</sup>

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the test and control plan.

#### 3.2.1.2 Other tasks for the manufacturer

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

## 3.3 CE marking

The CE marking shall be affixed to the packaging or on the accompanying commercial documents, e.g. EC declaration of conformity. The letters "CE" shall be followed by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the European technical approval,
- identification of the product (trade name),

<sup>10</sup>

The test and control plan is a confidential part of the European technical approval and only handed over to the approved bodies involved in the procedure of attestation of conformity. See section 3.2.2.

**4 Assumptions under which the fitness of the products for the intended use was favourably assessed**

**4.1 Manufacturing**

Depending on composition and manufacturing process the components of the GRK shall comply with those on which the approval tests were based.

The ETA is issued for the GRK on the basis of agreed data and information, deposited with DIBt, which identifies the GRK that has been assessed and judged. Changes to the GRK or the components or their manufacturing process, which could result in the deposited data and information being incorrect, shall be notified to DIBt before the changes are introduced. DIBt will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA, and if so whether further assessment or alterations to the ETA is required.

The substrate must not contain any significant impurities.

Only products according to Table 1 may be used. The individual components for the GRK shall be compatible with each other.

**4.2 Installation / Execution**

The installation of the GRK takes place on site. The holder of approval is obliged to inform all persons entrusted with design and execution of the GRK of the Specific Conditions of this ETA and all further details necessary for a proper execution of the GRK.

Only the components may be used for the GRK that are specified in clause 1.

When installing the GRK, the processing instructions of the manufacturer shall be followed. The components shall be protected from weathering, solar radiation (UV) and mechanical damage during transport, storage and installation.

To protect the roof waterproofing from root penetration a root barrier layer shall be arranged, provided that no "root-resistant" roof waterproofing was performed. The entire roof including connections to other building components, penetrations, etc. shall be carried out root-resistant.

The root barrier layer shall be covered immediately after laying in order to avoid a longer weathering. The joints of the layers shall be connected in a suitable manner.

Depending on the roof waterproofing executed, a suitable protection mat shall be used.

Depending on the compressive strength of the drainage elements, these shall be protected during the execution such that they will not be damaged.

For the protection mats, filter fleece and drainage elements, the following maximum durations of exposure after installation shall be observed:

Table 12: Maximum duration of exposure of the protection mats, filter fleece and drainage elements

Protection mat /drainage element / filter fleece	Maximum duration of exposure
Separation, protection and storage fleece RMS 350	1 month
Drainage and storage element FKD 40	1 month
Filter mat type 105	2 weeks

The roof shall be equipped with an appropriate drainage. For roofs with a roof pitch less than 2 % special requirements for dewatering and drainage are required.

The roof shall be designed such that no stagnant water will develop over a longer period of time. The roof structure, the roof pitch and the planting of the green roof shall be coordinated.

The execution of the drainage shall be carried out in accordance with EN 12056-3:2001 and shall take national provisions into account.

The roof system executed shall provide sufficient resistance to wind load (wind suction), depending on the location of the building. The roof structure shall be designed such that it can transfer the additional loads from the green roof.

Only undamaged products may be used. The surface on which the GRK is laid shall be sufficiently flat. The components shall be laid single-layer.

When using plants with a strong rhizome growth (e.g. different types of bamboo), this shall be taken into account by special measures in addition to the root barrier layer when executing.

Depending on the green roof carried out and the existing vegetation regular maintenance of the green roof is required (eg, cleaning, removing unwanted vegetation, control of drainage, plant care).

In addition to the provisions of this ETA there may be requirements applicable to the kit or components of the kit, which shall also be complied with.

## **5 Indications to the manufacturer**

### **5.1 Packaging, transport and storage**

The components of the GRK shall be packed and/or covered such that they are protected from weathering, solar radiation (UV) and mechanical damage during transport and storage.

Dirk Brandenburger  
Abteilungsleiter

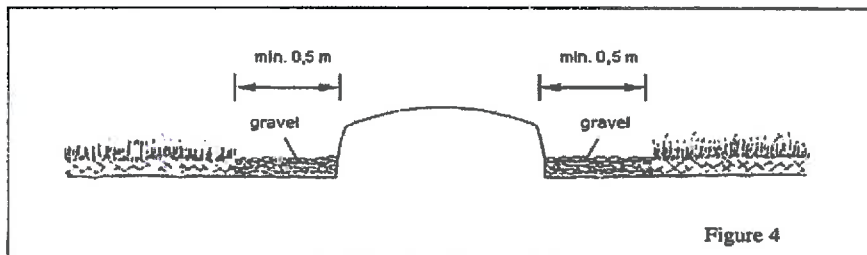
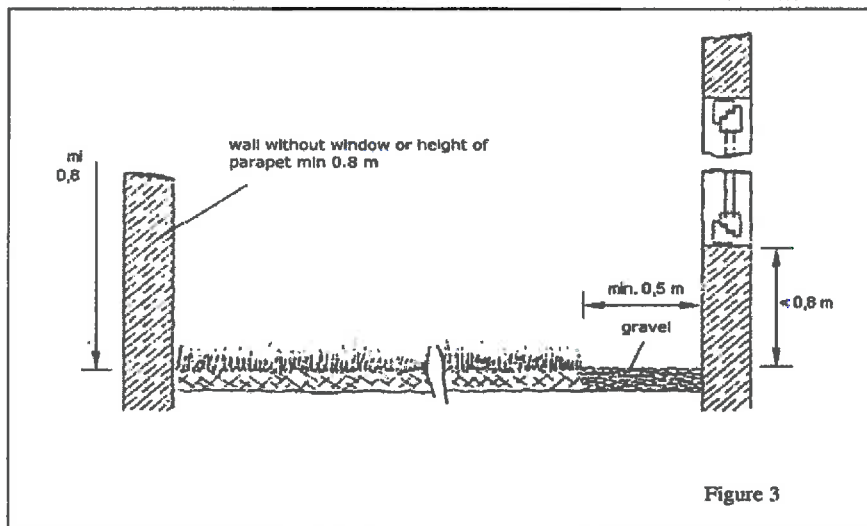
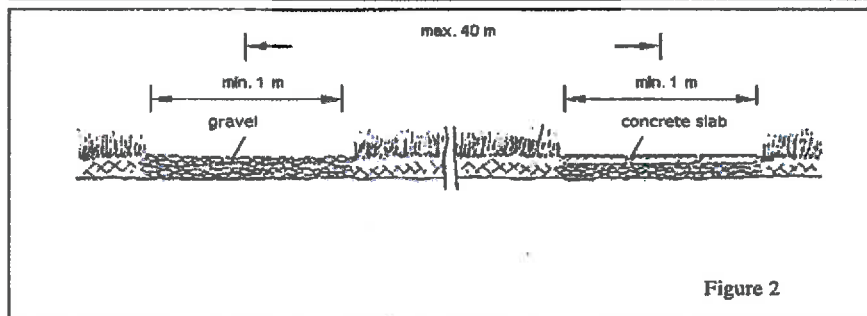
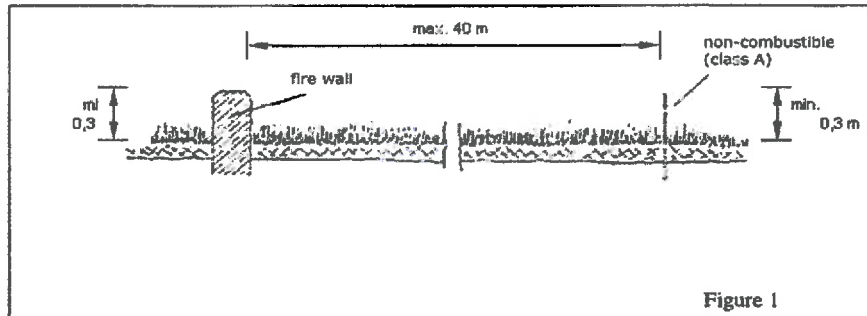
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## External fire performance – assessment without testing

For the assessment of the resistance to external fire the following criteria shall be applied:

- 1 Roofs with intensive greening and roof gardens - that are those, which are irrigated and cultivated and usually have a thick vegetation support layer - have to be assessed as resistant to external fire in accordance with class B<sub>ROOF</sub> (t1) according to EN 13501-5:2005+A1:2009.
- 2 In the case of roofs with extensive greening of mainly low-growing plants (e.g. grass, sedum, erica), the resistance to external fire in accordance with class B<sub>ROOF</sub> (t1) according to EN 13501-5:2005+A1:2009 is given if
  - 2.1 a vegetation support layer of at least 3 cm thickness (roof garden soil, soil substrate) with maximum 20 % by weight organic material exists.  
In the case of a build-up which does not correspond to that (e.g. substrate with a higher proportion of organic material, vegetation mats made of foam materials), a test according to 2.4.2.1 with a roof slope of 15° and in dry condition (equilibrium moisture at a climate of 23°C/50% relative humidity) is to be carried out without planting.
  - 2.2 end walls of the building, fire walls or walls permitted instead of fire walls are guided at intervals of maximum 40 m, minimum 30 cm over the green roof (top edge of substrate and/or soil (see Figure 1). Unless based on the provisions of legal building regulations these walls do not have to be guided over the roof, an upstand of 30 cm in height made of non-combustible construction materials or a band of 1 m in width made of solid slabs or coarse gravel is also sufficient (see Figures 1 and 2).
  - 2.3 in front of openings in the roof surfaces (roof-lights, domed roof-lights) and in front of walls with openings a band of at least 0.5 m width made of solid slabs or coarse gravel is arranged, unless the parapet of the wall opening is more than 0.8 m high over the top edge of the substrate. In front of roof exit doors solid slabs or coarse gravel are to be laid in an area of at least 1 m x 1 m (see Figures 3 and 4).
  - 2.4 in the case of adjoining buildings with gables towards the street, a band measured in the horizontal of at least 1 m width remains without vegetation in the area of eaves and provided with a roof covering made of non-combustible construction materials.

Naturdach	Annex 1.1
External fire performance – assessment without testing	



Naturdach	Annex 1.2
External fire performance – assessment without testing	